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ABSTRACT

Ropes and their uses for the sailor are the focus of this unit. Students begin the study by taking apart a section of rope and putting it back together, testing strength at various stages. They also practice tying different knots and learn about the uses of ropes in sailing. After investigating the mechanics of a block and tackle, students consider how ropes, ships and sailors have influenced the English language. Provided along with the students' guide is a teacher's manual which contains a materials list, objectives, recommended teaching approaches, an answer key, and evaluation items. (Author/WB)

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EP-18

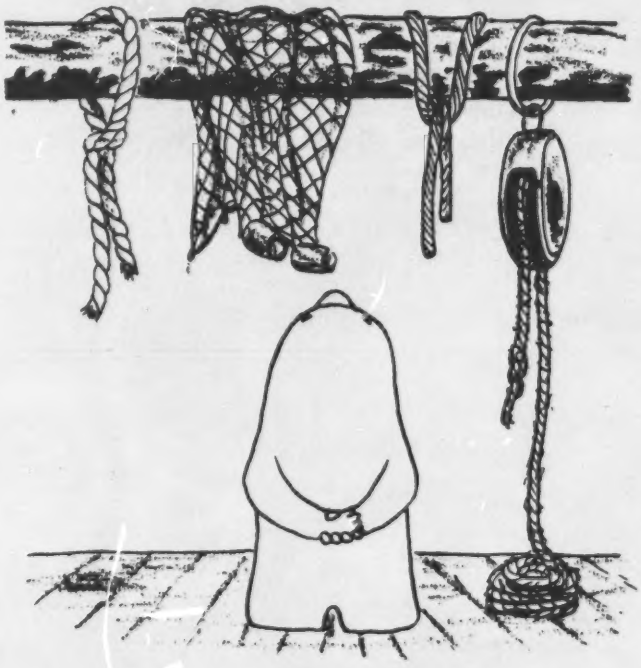
Ohio Sea Grant

OEAGLS-Oceanic Education Activities for Great Lakes Schools

KNOWING THE ROPES

by

Rosanne Fortner and Victor J. Mayer,
The Ohio State University



Ohio Sea Grant Program
Charles E. Herdendorf, Program Director
Victor J. Mayer, Principal Investigator

SE 035 154

OEAGLS Investigation #22
Completed January, 1981

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Activities A and B were adapted from the People and Technology curriculum materials, which were developed in 1972 by the Social Studies Program of the Education Development Center, Inc., 15 Mifflin Place, Cambridge, MA 02138.

STUDENT GUIDE

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INVESTIGATION

KNOWING THE ROPES

INTRODUCTION

Can you do macrame? Have you seen the art work made using this craft? In macrame the craftsperson works with rope, much as the sailors did on sailing vessels in the early days and as the fishers on Lake Erie do today.

You have probably seen pictures of some of the beautiful sailing ships from the nineteenth century or the Tall Ships from America's bicentennial celebration. Today the sailboats you see on the reservoirs and lakes of Ohio use ropes. This investigation considers several things about those ropes--how they were made, what their uses are, and how they have been the origin of some common expressions in our language and some interesting art forms.

When you have completed this investigation, you should be able to:

1. Explain in general terms how a rope is made and what makes a rope strong.

2. Discuss the importance of ropes for

   a. the two types of ship rigging and

   b. the individual sailor.

3. Tie three knots that sailors use and tell what each knot is used for.

4. List two common expressions in our language that have to do with the ropes or the life of the sailor on early ships.

ACTIVITY A

HOW IS A ROPE PUT TOGETHER?

The making of rope is one of the oldest of arts. The Egyptians, the Chinese, the American Indians, the Romans, the Greeks and the Anglo-Saxons made ropes. Boston imported a rope maker from England in 1641, and the art grew rapidly into the nineteenth century.

MATERIALS

A piece of hemp rope about 75 cm long; several other types of ropes for comparison; bucket made from a tin can; rocks or other heavy objects for weights.

PROCEDURE

1. Carefully untwist one end of the hemp rope. The largest pieces of the rope are called strands. Strands are made up of yarns, and each yarn contains a great many fibers.

Examine the parts of the rope and record your observations in this chart:

Rope size (length, diameter)	
Number of strands	
Strand twist direction*	
Number of yarns in each strand	
Yarn twist direction*	
Number of yarns in whole rope	
Number of fibers in one yarn	
Number of fibers in one strand	
Number of fibers in whole rope	
Fiber twist direction*	

*Clockwise or counterclockwise

2. Separate all the fibers in one yarn into 3 or 4 piles according to their length. What do you observe about fiber length?

_____

3. Are all the fibers of the same thickness?

_____

4. Can you split a fiber into smaller fibers?

_____

These fibers come from the stalk of the hemp plant that grows in many parts of the world. Other natural fibers that are made into ropes include sisal, jute, cotton, flax and "Manila," a fiber from the leafstalk of a banana that grows in the Philippines. Before they can be made into ropes, natural fibers are combed, cleaned and straightened.

5. Pull on the ends of some fibers to break them with your hands. Are thick fibers stronger than thin fibers? _____

6. Untwist another yarn and loosen all the fibers. Hold the whole bundle of fibers in one hand and with the other hand slowly pull a few fibers out of the bundle (Figure 1). Pay attention to how it feels to pull the fibers apart.

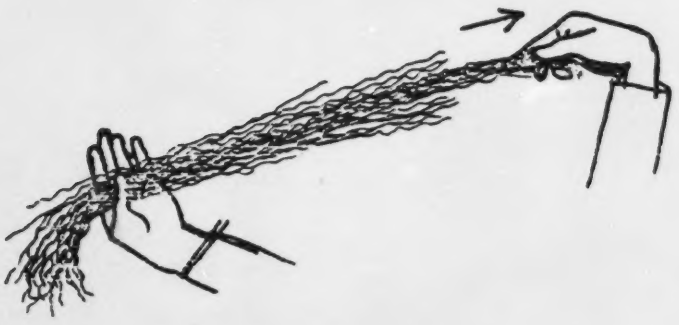


Figure 1. Pulling fibers from an untwisted bundle.

7. Put the fibers back together and give the whole bundle five or ten twists. Now pull out a few of the fibers (Figure 2).

Figure 2. Pulling fibers from a twisted bundle.

How is this different from pulling the untwisted fibers?

_____

_____

8. You can probably guess that the strongest ropes are those with the most fibers twisted together. You can test this idea scientifically.

Take one long fiber and pass it through the handle of a "bucket" made from a can and a string. Hold the ends of the fiber and let the can dangle at a point 1/3 of the distance between your hands and in Figure 3. (The 2/3 end of the fiber can be used in the next step.)

Figure 3. Can of weights hanging on fibers.

Add small rocks or marbles to the can until the fiber breaks. Weigh the can with these weights in it and record the total in the chart below.

Now take the long end of the fiber and twist it 10 times. Record how much weight a single twisted fiber can hold up.

Repeat this procedure with bundles of 3 and 5 fibers, first untwisted, then twisted. Record your results in the table and see if your guess about rope strength was correct.

Number of fibers	Weight Supported	
	Untwisted	Twisted
1		
3		
5		

9. Modern ropes are made of various kinds of materials. If another kind of rope is available, you may want to take it and describe how it was put together.

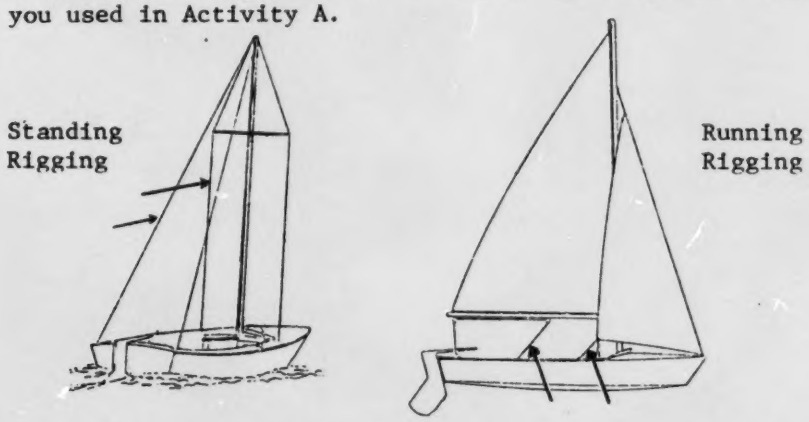
Ropes made of synthetic fibers (fibers made by people) are usually stronger than natural fiber ropes of the same size. Sailboats on Ohio lakes therefore use mainly nylon and dacron ropes instead of hemp.

ACTIVITY B

HOW DO SAILORS USE ROPES?

If you have ever seen a sailboat in Ohio waterways, maybe you have noticed how many ropes are in use. The sailors rely on ropes to perform many functions on the boat.

Rigging is the term used for all the lines of rope on a sailboat. There are two kinds of rigging. The running rigging runs through pulleys and gives the crew a way to control the sails from the deck. The standing rigging does not move; it supports and helps to steady the masts. The standing rigging on modern sailboats is often made of wires twisted together for strength, much like the ropes you used in Activity A.



MATERIALS

Sections of rope of different diameters and about 75 cm long, broompole or standing pipe, two blocks, four 1-meter sections of twine.

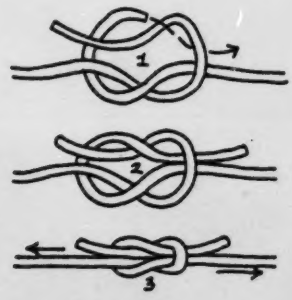
PROCEDURE 1

KNOTS

To make the ropes hold themselves in place and to their jobs in the rigging, sailors use knots. Look at the following diagrams and practice tying the knots until you can make at least 3 knots without looking at the pictures.

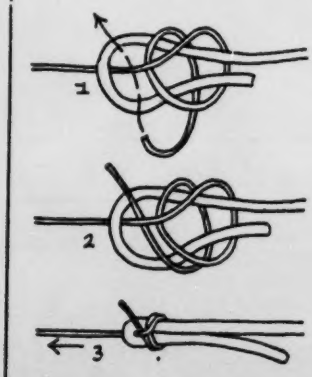
Square Knot (Reef Knot)

Used for so many things on a boat that it is often called the Sailor's Knot. Used to join two lines of the same thickness; will slip if the lines are unequal in size.



Becket Bend (Sheet Bend)

Used for joining two lines together, even if they are of different thicknesses. The thinner line should be "bent" around the heavier line.



Fisherman's Bend

An extremely strong knot for tying a line to a ring on an anchor, or buoy or a spar (mast or boom). Will not slip or jam and is easy to untie.

6

Clove Hitch

Used to make things secure, tie them down. Easy to tie and untie, and tightens as strain increases on it.

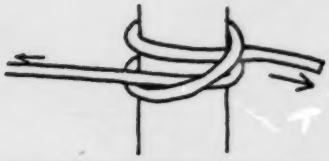
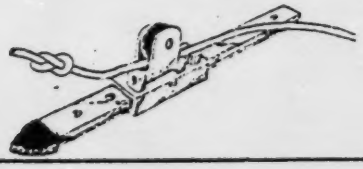


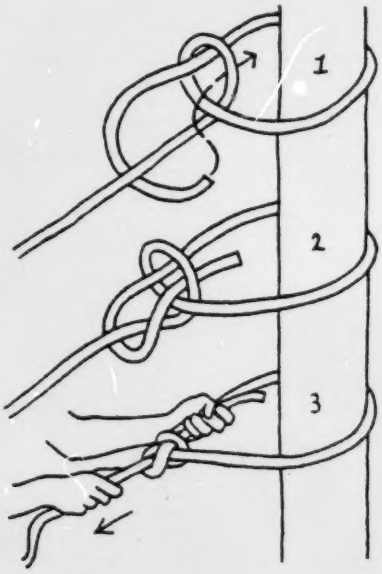
Figure Eight

Used as a stopper knot to keep a line from running out of a block, grommet or other opening. Will temporarily keep a line from unraveling at the tip.



Bowline (bō-lin)

Used to form a loop that will not close—to throw over a post or attach to a ring. Known as the king of knots because it is easy to tie and untie, and will not slip or jam.



According to the Great Lakes Historical Society, the knots used by sailors on the Great Lakes were adapted from the ocean-going seamen soon after the Lakes trade was established. It is likely that Lakes sailors did not use as many different knots as seamen did, because some knots were lost in the transfer or simply were not needed on the Lakes because of differences in ship design.

One very important use of knots is in the making of nets. The fishing industry on the Great Lakes refers to its nets as "twine." In this activity you are using a type of cotton thread that is also called twine.

Early sailors probably did not use ropes for decorative items, because ropes were expensive and were always needed for more important jobs on the ship. Today, however, the art of making knots is practiced in a type of handicraft called macrame (mack-ruh-may). You may have seen belts, plant hangers, purses, wall decorations or jewelry made out of knotted ropes. You can make some simple macrame pieces using only the square knot that you have learned. Try making a long chain of square knots, one after the other, or a chain of 6 knots, then a space, then 2 knots, space, 6 knots and so on. If you use thin cords, this could make a choker necklace. Thicker cords could make a belt.

PROCEDURE 2

BLOCKS

A block on a ship (in 1840) was a chunk of wood with one or more pulley wheels inside. (Modern blocks are made of steel.) The wheel allows line to run freely through the block. There are two principal ways to use a block on a sailboat: when the block is fixed to something immovable, like the hull of the boat, the block can be used to change the direction of pull on a rope. Blocks can also be used to increase the amount of weight you can pull, so that one person can raise a sail or control its position with no help.

You can demonstrate in the classroom or on the schoolgrounds just how blocks can help to move heavy things.

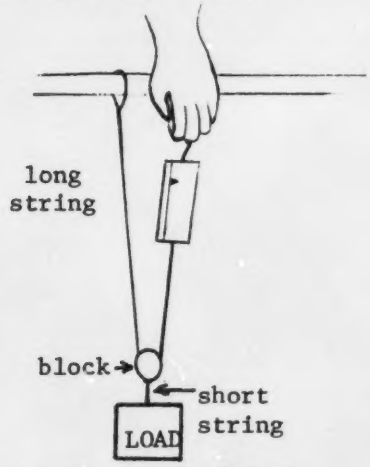
A. Take a piece of twine about one meter long, attach one end to a spring scale and the other end to a small heavy object. Raise the object up by holding onto the free end of the scale as shown.

1. How much weight did the scale indicate you were lifting?

_____

Now let's consider how a block can increase the amount you can lift.

Using an appropriate knot from pages 5-6 tie the twine so it hangs down from something. Run your twine through a block or pulley and attach the twine to the spring scale. Using another short string, attach your load to the block as shown and lift the weight as you did before.



2. Now, how much weight did the scale indicate you were lifting?

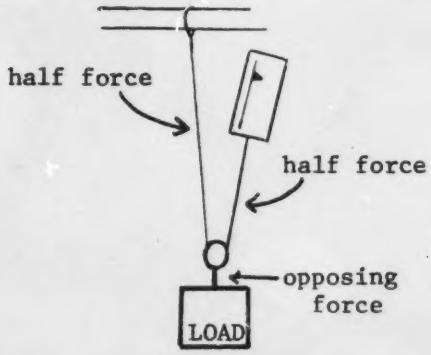
_____

Compare this answer to the answer to question 1.

_____

_____

The diagram below shows what is happening.



Since you are pulling on one end only, and the bar where the twine is attached is "pulling" on the other, you are pulling only half as hard as you would if you pulled on both. Therefore this arrangement of block and line enables you to exert a force twice as large as the force you apply.

3. Try adding another weight of the same size onto your load. How much weight did the scale indicate you were lifting?

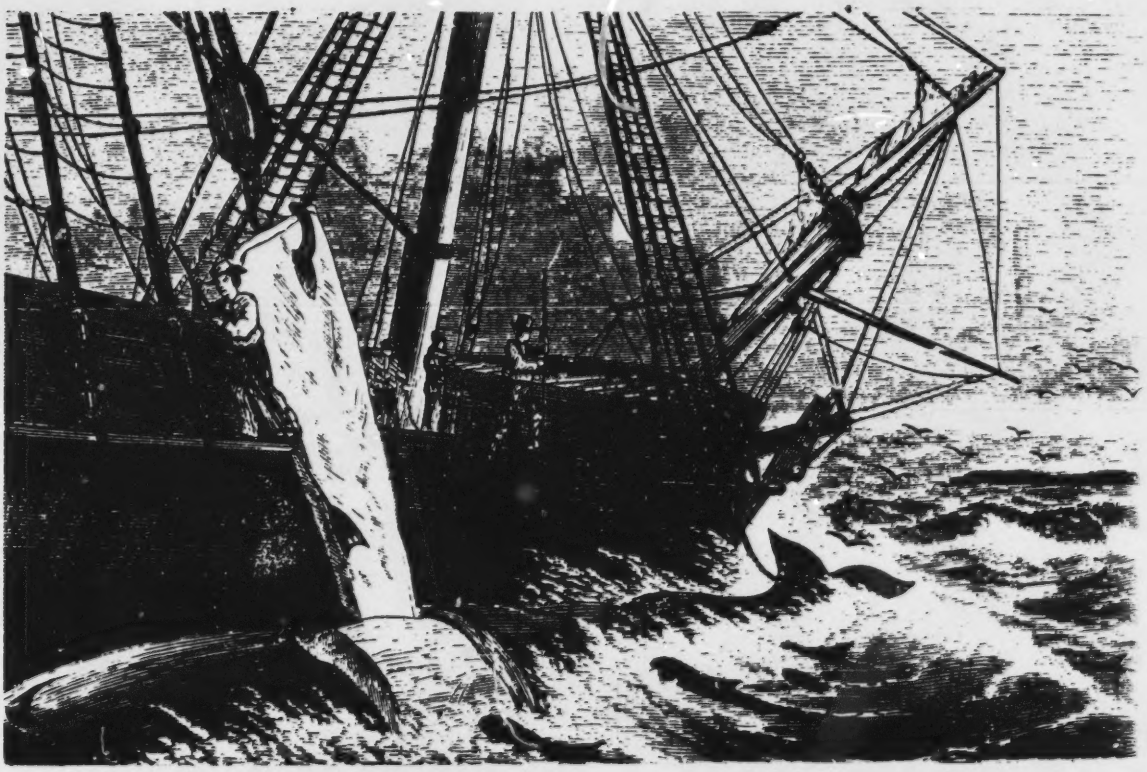
_____

Is this answer about the same as your answer to question 1?

_____

The block has helped you to pull twice as much weight using the same amount of strength.

On a large sailing ship there is a great need for increasing muscle power to overcome the huge wind force produced in the sails, to raise the anchor, to hoist the boats, and to do a hundred other heavy tasks. On a whaling ship, huge blocks and lines were used for even more things, such as pulling the blanket piece (blubber) off of the whale.

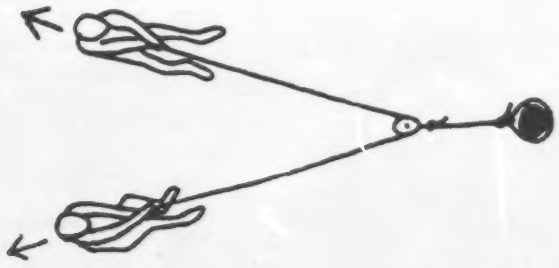


"Cutting-in," from The American Whaleman, by William M. Davis.

B. To really see the effect of using blocks to "increase" strength, try these exercises outdoors.

Find two people in the class who have just about equal strength in pulling. Try some tug-of-war games between two people at a time and match students according to their strength. Use strong rope and wear gloves to avoid rope burns.

1. Set up the situation below using people of equal pulling strength.



Does one puller have to pull harder than the other in this case?

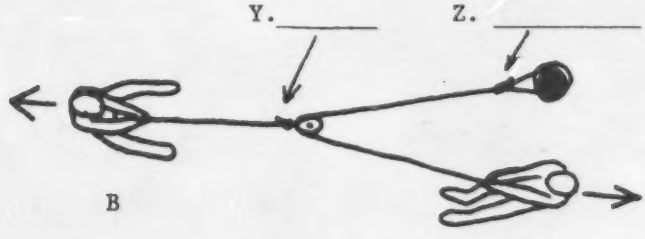
_____

On a sailboat or a sailing ship, how might such an arrangement be used?

_____

_____

2. Now arrange your rigging as in the next diagram. Label the knots you used at points Y and Z.



Which person appears to be stronger? _____

3. Add more people, one at a time, to position B. How many pullers does it take at B to balance the puller at A?

   _____

4. Add a puller at A. How many people at B can the two A pullers balance?

   _____

5. Hook up two blocks with ropes as shown below. Who do you think will have the advantage?

   _____

Were your predictions correct? _____

How many pullers can a single puller balance using this set-up?

_____

6. If you had to pull this same "load" of people without using blocks, how many pullers would the job require?

   _____

7. How does a "block and tackle" compare to "people power" in terms of cost and convenience?

   _____

   _____

   _____

   _____

ACTIVITY C

HOW HAVE ROPES, SHIPS AND SAILORS INFLUENCED OUR LANGUAGE?

The title of this investigation, "Knowing the Ropes," reminds us that some expressions the early sailors used are now a part of our everyday language. A person who "knows the ropes" today is an expert who knows what to do. In early sailing days the new sailor usually did not know much about the ship's rigging. By the time his training voyage was over, though, his discharge papers could be marked "knows the ropes."

MATERIALS

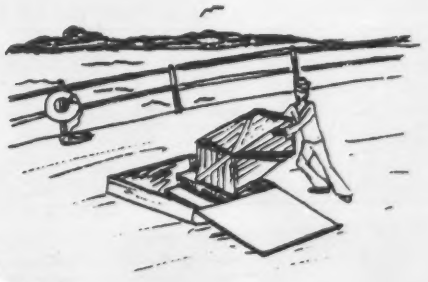
None

PROCEDURES

A. Listed below are some common expressions that had their beginnings at sea. Think about what each one might have referred to on an early sailing ship. Then try to match the saying with the picture that shows its meaning. Write a sentence under each picture to tell what the saying means in our modern language.

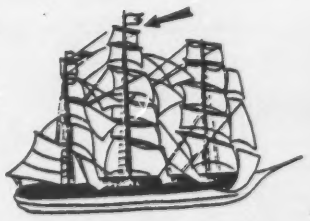
1. stand by
2. making ends meet
3. skyscraper
4. down the hatch

a. _____
_____
_____



b. _____
_____
_____

c. _____
_____
_____



d. _____
_____
_____

B. Read the following paragraphs about the original meanings of some other common expressions. On a separate sheet of paper, draw a picture that shows the original meaning for at least one of the sayings.

1. The expression 'he let the cat out of the bag' today means that someone told something he shouldn't have told. Many years ago, this sentence would have brought fear in the person who had just done something wrong. Because of his wrong doing, the cat-of-nine-tails was brought out of a canvas bag. The cat was made of nine pieces of rope, each about 18 inches long with three knots at the tip. Flogging, at the very least, would cause severe wounds. The U. S. Congress prohibited the use of the cat in 1850.

2. On board ship, a sailor's misdeeds were recorded daily, and punishment (flogging with the cat) was carried out on the following Monday: thus the birth of the expression "blue Monday."

3. When sailors went ashore they visited the seaport pubs frequently. When their money ran out, they were extended credit. A tally board was kept of the pints and quarts they consumed. The quartermaster of a ship would remind his crew to "mind their P's and Q's," since this showed how much they'd been drinking.

4. Two expressions that are still used by mariners are log and knots. Sailors record information about their adventures in a daily "log" which is similar to a diary. These recorded journals got their name from the term "chip log." A chiplog was a device used by sailing ships to measure velocity in "knots." The device consists of a flat triangular piece of wood (5" on each side) with a long rope attached to the center. The rope was marked every 47 feet, 3 inches, by a knot. The "log" was thrown overboard and allowed to trail behind the ship. As the ship moved forward, the object pulled more and more rope overboard . Sailors could measure how much rope was trailing by keeping track of how many knots on the rope pulled overboard in 28 seconds. The result is the rate of speed of the vessel, which was written as "knots." (Knots means velocity in nautical miles per hour. One nautical mile is about 6,076 feet or 1800 meters.)

C. The language of sailors on the Great Lakes is different from that of "salty" sailors. All vessels on the lakes are called boats regardless of their size. The Captain is not said to be "in command." He "sails the boat," while the Chief Engineer "runs the boat." Speed is measured in miles per hour, never in knots. A boat that can go more than about 12 mph is a "slippery" boat that can pass up all the others.

In going through the lakes, cargo boats are "downbound" if heading toward the sea, and "upbound" if heading inland. In most lakes this is easy to remember, but in Lake Michigan, a steamer going to Chicago is upbound even though it is sailing to the south! In each lake below, can you draw arrows that point in the upbound direction?

REVIEW QUESTIONS

1. Describe how a natural fiber rope is put together.

_____

_____

_____

2. How does twisting affect the strength of rope fibers?

_____

_____

3. What do sailors use the following knots for?

A. square knot

_____

_____

B. figure eight

_____

_____

C. bowline

_____

_____

D. clove hitch

_____

_____

4. List two common expressions that came into our language from their use in sailing.

_____

_____

_____

5. What do sailors use to help them raise very heavy things like sails or anchors?

_____

6. What is the difference between standing rigging and running rigging?

_____

_____

7. In what ways are ropes important in sailing?

_____

_____

_____

_____

8. What name is given to the art of using knots to make useful or decorative items?

_____

EP-18

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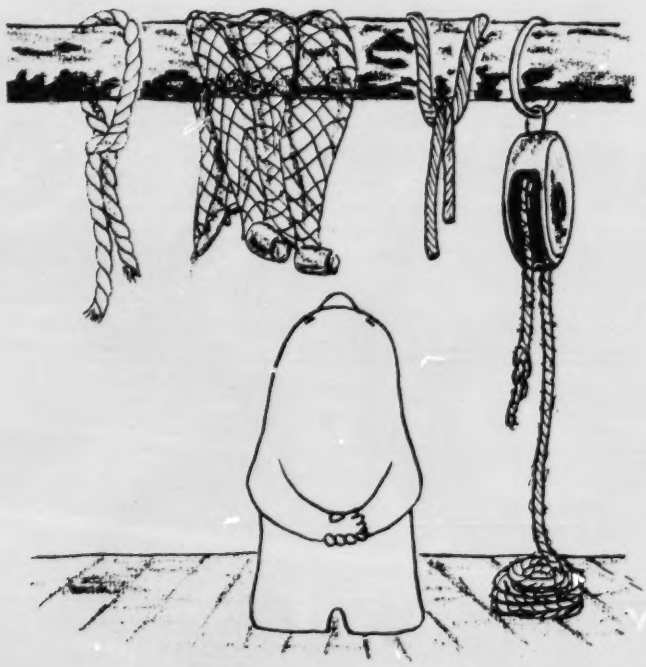

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TEACHER GUIDE

OEAGLS Investigation #22
Completed January, 1981

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INVESTIGATION

KNOWING THE ROPES

OVERVIEW

This is an interdisciplinary investigation that focuses on ropes and their uses for the sailor. The first activity is concerned with how ropes are made and what makes them strong. Students "unmake" a section of hemp rope and them put it back together a bit at a time, testing strength at various stages.

Activity B tells how ropes are important in sailing. Students learn to tie different knots and then discover the advantages of using a block and tackle.

Finally students consider how ropes, ships and sailors have influenced our language. Some sayings that originated at sea are matched with their original meanings and their present day connotations. Students illustrate what is meant by other mariners' expressions.

PREREQUISITE STUDENT BACKGROUND

None

MATERIALS

Activity A: For each team--a piece of hemp rope about 75 cm long, several other types of ropes for comparison, empty tin can with "handle" of wire (construction outlined under PROCEDURE), 20 pounds of rocks or other weights. For whole class: one bathroom scale.

Activity B: For every 2 students--two pieces of twine and one piece of heavier cord, each about one meter long. For every 4 students--two small pulleys, horizontal bar (such as a broom pole laid across the space between two table tops), a notebook ring or curtain ring. For entire class (optional) two large pulleys, two 4-meter lengths of heavy rope (about ½-inch diameter), one 1-meter length of same rope, and access to the school's flagpole.

Activity C: Pencil or pen for each student.

OBJECTIVES

When students have completed these activities they should be able to:

1. Explain in general terms how a rope is made and what makes a rope strong.

2. Discuss the importance of ropes for:

   a. the two types of ship rigging, and
   b. the individual sailor.

3. Tie three knots that sailors use and tell what each knot is used for.

4. List two common expressions that have to do with the ropes or the life of the sailor on early ships.

SUGGESTED APPROACH

Activities A and B are best done in teams of 3-4 students. The outdoor part of Activity B is done as a demonstration by students matched for their pulling strength. Activity C is best done by individuals and then discussed with the entire class. Activities A and C will take about one hour (or one class period for upper grades). Activity B will probably take 1½ to 2 hours.

ACTIVITY A

HOW IS A ROPE PUT TOGETHER

PROCEDURE

Keywords: fiber, strand, yarn

1. Answers will vary according to the size of the rope used. An example is given below:

Rope size (length, diameter)	75 cm long, 5 mm diameter
Number of strands	3
Strand twist direction	Counterclockwise
Number of yarns in each strand	3
Yarn twist direction	Clockwise
Number of yarns in whole rope	9
Number of fibers in one yarn	About 100
Number of fibers in one strand	About 300
Number of fibers in whole rope	About 900
Fiber twist direction	Slightly Clockwise

2. Fibers come in all different lengths. A number of them are as long as the rope section, but most are shorter.

3. No, some fibers are very thick and others are so thin that they break upon contact.

4. A single fiber can't be divided into smaller fibers.

5. Yes, thick fibers are stronger than thin fibers.

7. It is much harder to pull long fibers out of a twisted bundle.

"Buckets" should be made in advance for Step 8. Use 3-pound coffee cans or similar sizes. Punch holes in opposite sides using a can opener, then make a handle using wire or strong cord. Each team needs one bucket.

Caution students not to raise the weighted cans higher than 2-3 inches off the table. This should avoid much noise and the possible spilling of weights when the fibers break.

If scales are not available for weighing the buckets and their contents, use weights of fairly uniform size and have students count the weights as they add them to the bucket. They can then record the number of weights supported by each situation.

Answers to the chart in #8 will vary, but in general, twisted fibers should support more weight than the same number of untwisted fibers, and larger numbers of fibers should support more than fewer fibers. An example of results might be as follows:

Number of fibers	Weight Supported	
	Untwisted	Twisted
1	3 lb.	3 lb.
3	4½ lb.	8½ lb.
5	9½ lb.	17 lb.

NOTE: Caution students not to toss weights into the bucket. This will cause the fibers to break too soon and students will not get a true picture of the fibers' capacity to support weight.

9. Clothesline rope makes an interesting comparison. In this type of rope, fine threads are braided into a tube surrounding a core of cotton. Neither the individual threads nor the core itself have much strength alone.

ACTIVITY B — HOW DO SAILORS USE ROPE?

PROCEDURE 1

Keywords: standing rigging, running rigging, macramé

All students should read about every knot and how it is used. Students then work in groups to practice how knots are made.

It should not be necessary to test each student's ability to tie 3 knots. Team members can check each other's work. You may wish to reinforce the skills and knowledge by having volunteers demonstrate the knots and tell how they are used.

Macramé

If you decide to pursue the macramé aspect of knot-tying, it is suggested that this be done by interested students only, preferably out of class. This type of activity does not appeal to all students.

You can encourage those who are interested by having on hand some instructions for simple projects. Numerous books of macrame projects are available from craft shops and department stores. One good example is "Kids Can Macrame," by Craft Publications #7256, Norcross, Georgia, 30091.

PROCEDURE 2

Rural students may be familiar with the principles of a block and tackle (or block and line, in sailing terms). Such devices are commonly used for hoisting hay bales into barns, stretching fences, and pulling heavy objects. On a sailboat, blocks are used in the running rigging.

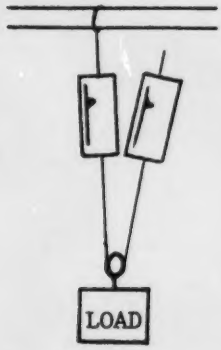
A. For the "load" to be pulled, use any object that causes the spring scale to measure in the upper half of its load limit. For example, if the scale measures up to 200 grams, choose objects that weigh 100 grams or more. When you weigh the load, add to it the weight of the pulley for Step 2. Otherwise measurements for further questions may not be as accurate.

1. Answers will vary depending on the load used.

For Step 2, have students raise their load from the floor as shown in the diagram. Emphasize that lifting should be straight up toward the bar, since pulling at an angle will decrease the effect of the pulley. Small pulleys from a hardware store may be used. For knots, the best suited for the pole is the bowline or clove hitch. The bowline or fisherman's bend would be good for other attachments. Square knots are commonly used, but they will not hold dependably when the pull on them is in one direction only.

2. Answer should be about ½ of the answer to question 1.

In explaining why this happens, please note that the same amount of force is acting in Steps 1 and 2. The reason the scale shows less weight being lifted is that the force is now divided between two lines, each taking half the strain. If you attached an extra spring scale to the rope where it meets the horizontal bar, the readings on both scales should add up to the original weight measured. Therefore, the same force is acting, but the puller is applying only half the force. (See diagram on next page.)



3. Answers should be about the same as #1.

B. This section should be approached as another means of demonstrating and extending the concept in section A. Precautions should be taken to prevent falls and rope burns.

1. Both should be pulling equally hard. On a sailboat, such an attachment might be used on the edge of a sail to allow some flexibility of movement as the wind changes.

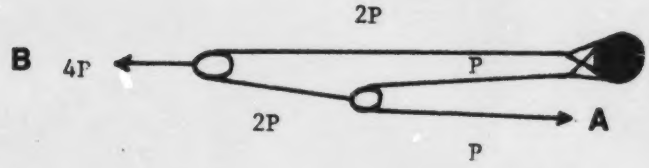
2. Y - fisherman's bend or bowline most likely. Figure eight is acceptable if used as a stopper and not an attachment to the pulley itself.

   Z - bowline is shown, but clove hitch will also work well. Again, square knots may slip in either position, and at best they will fold in on themselves and become a different knot called a buntline.

3. Two people are needed to balance the puller at A.

4. Four people are needed to balance A.

5. Again, person A will have the advantage. A can balance 4 pullers with this set-up. This can be illustrated if we let P stand for the pull of one person:



6. Four pullers would be required to pull a 4-person load.

7. It is more efficient in terms of personal energy and convenience to use blocks. In this way, one person's labor is "magnified" and fewer laborers would be needed.

ACTIVITY C — HOW HAVE ROPES, SHIPS AND SAILORS INFLUENCED OUR LANGUAGE?

PROCEDURES

A-a. Making ends meet. Today this means getting by financially.

b. Down the hatch. Today's meaning: to take in food or drink.

c. Stand by. Today this means wait, usually until something else happens.

d. Skyscraper. In modern language, a very tall building.

B. Students should enjoy drawing the pictures to illustrate these terms. Please be accepting of unique ideas and marginal artwork. The intent of this section is for students to visualize the setting for word origins.

You may be interested in finding other marine-related terms and discussing their original and modern meanings. Here are some others to start your thinking:

high and dry	grease the ways
taking the bait	first rate
hook, line and sinker	laid up
junk	out of commission
marinate	to flounder
pipe down	ship shape
keel over	aboveboard

C. Arrows in the upbound direction are shown below. Note that either direction is upbound in Lake Michigan, because boats going from Chicago to Duluth would be upbound, and one going to Chicago would also be upbound. There is considered to be only one upbound direction in Lake Superior, however.

REVIEW QUESTIONS

1. Many fibers are twisted together into a yarn; several yarns are twisted to make a strand, then several strands are twisted together in the opposite direction to make a rope.

2. Twisting makes a bundle of fibers almost twice as strong as the untwisted bundle.

3A. Square knots are used to join two lines of equal size. Many uses on a boat.

B. A figure eight is used as a stopper knot and to keep rope ends from fraying.

C. A bowline forms a loop to throw over a post or attach to a ring. The loop will not close.

D. A clove hitch is used to tie things down or tie them to a post or rail.

4. Accept as answers any of the terms presented in Activity C.

5. Blocks and lines help sailors raise heavy things.

6. Standing rigging holds things in place, like the masts. Running rigging is designed to help the crew move things like the sails or the anchor.

7. Many answers are acceptable, including some that students know of which are not included in this investigation Answers may include holding the masts up, tying things down, tying the boat to the dock, raising sails and anchor, and such.

8. The art of tying knots is called macramé.

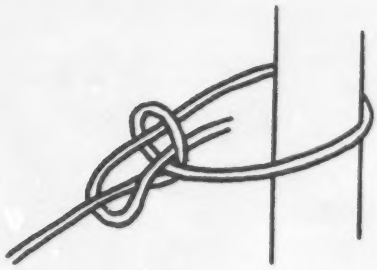
REFERENCES

Berthier, Marc P.G. The Art of Knots (A Sailor's Handbook). Doubleday & Company, 1977.
A reference to knots of all degrees of difficulty, including how they are used on board ships.

Boy Scouts of America, Fieldbook. North Brunswick, N.J., 1972.
Shows practical applications of many kinds of knots.

Kids Can Macramé, 1978. Craft Publications #7256, Norcross, Georgia, 30091.

EVALUATION ITEMS



1. The knot shown above is called a

   a. clove hitch.
   b. fisherman's bend.
   * c. bowline.
   d. square knot.

2. The same knot pictured above is used by sailors to

   a. join two lines of unequal size.
   * b. make a loop that will not close.
   c. tie things down aboard the boat.
   d. join two lines of equal size.

3. The art of making useful or decorative items from knotted rope is called

   a. ropology.
   b. decoupage.
   c. scrimshaw.
   * d. macramé.

4. The ropes used to hold masts and spars in place on a boat are called the

   a. block and tackle.
   b. upright complex.
   * c. standing rigging.
   d. running rigging.

5. Which of these sayings did not have its beginnings in language of the sea?

   * a. Puddle jumper
   b. Skyscraper
   c. Down the hatch
   d. Stand by

6. Which of the following would make the strongest rope?

   a. five fibers, untwisted
   b. five fibers, twisted
   c. ten fibers, untwisted
   * c. ten fibers, twisted

7. In a natural fiber rope, the fibers are

   a. of different thicknesses but all the same length.
   * b. of different lengths and thicknesses.
   c. of different lengths, but all the same thickness.
   d. all the same size and strength.

8. On a boat, blocks are used to

   * a. increase the amount of load a person can move.
   b. caulk cracks and make the hull water tight.
   c. keep the ropes in neat coils.
   d. hold the hatch cover down.

9. In the diagram above, how many people of equal strength at B can be balanced by the person pulling at A?

   a. four
   b. three
   * c. two
   d. one

10. In the Great Lakes, boats going away from the ocean are said to be

    a. outbound.
    b. downbound.
    c. inbound.
    * d. upbound.